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Social Interaction at the Maya Site of Copan, Honduras: A Least Cost Approach to Configurational Analysis

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CHAPTER 7

Social Interaction at the Maya Site of Copán, Honduras

A Least Cost Approach to Configurational Analysis

HEATHER RICHARDS-RISSETTO

Most archaeologists agree that the way in which ancient peoples arranged their physical surroundings, or in other words their built environment, provides a window to the past (e.g., Ashmore 1991, 1992; Ashmore and Sabloff 2002, 2003; Blanton 1989; DeMarrais et al. 1996; Lawrence and Low 1990; Moore 1996a, 1996b, 2005; Preziosi 1979a, 1979b; Reese-Taylor 2001; A. Smith 2003; M. Smith 2003, 2007). This is especially true for the ancient Maya, who scholars believe laid out their houses, monuments, and even roads to serve as a map of their worldview (Ashmore 1991; Ashmore and Sabloff 2002, 2003; Coggins 1980; Guillermin 1968; Houk 1996; Maca 2002). Most research of this nature tends to focus on cardinality, linking north, south, east, and west to representations of the heavens, earth, and underworld. Although such work is critical to our understanding of the ancient Maya, I believe that the advent of new technologies such as Geographic Information Systems (GIS) provides archaeologists with opportunities to begin to study Maya site configuration in new and more subtle ways.

In this chapter, I employ least cost paths to measure the relationship between site configuration and social connectivity at the ancient Maya site of Copán, Honduras. My research investigates two questions: First, did people of different social classes experience different degrees of social connectivity? And second, did people living in different parts of the city experience different degrees of social connectivity? From a theoretical perspective, my work is based on Charles Peirce's (1966) views of semiotics and regards site layout not simply as a reflection of ancient life but also as a mechanism that shaped ancient life (Giddens 1984; Jakobson 1980; King 1980; Moore 2005; Silverstein 1976). Along these lines, I view archaeological sites not just as anthropological features but as a combination of the built environment and the natural landscape. Ultimately, the goal of my work is to modify traditional configurational analysis using least cost methods to identify how social hierarchy was embedded in the landscape and how the ancient Maya may have strategically manipulated the landscape to structure social interaction and community organization at Copán.

At Classic period sites in the southern Maya lowlands, a social hierarchy existed that placed rulers at the top, members of the royal court just below, lesser nobles further down, and commoners at the bottom. As in many other ancient societies, cosmology provided the template and legitimization for this social structure. However, it was the daily routinization of these social categories that reinforced both the social and cosmic order (Joyce and Hendon 2000). This routinization was carried out, in part, through mechanisms such as access and visibility, which facilitated either social integration or segregation, depending on how societies employed them. The accessibility and visibility of buildings, roads, and other features serve as signs that influence how people move about landscapes, and people make use of this fact by organizing their surroundings to restrict access, channel movement, and display visual messages to elicit distinct responses from different groups of people (see, e.g., Fletcher 1981; Hudson this volume; Llobera 2006). Ultimately, the way in which people respond to the access and visibility of signs influences how different groups of people interact in the landscape. Although my research treats both accessibility and visibility, this chapter focuses explicitly on the role access may have played in establishing and maintaining sociopolitical relationships at Copán.

Other scholars have carried out accessibility studies in the Maya region (e.g., Sanchez 1997; Stuardo 2003; Yermakhanova 2005); however, my research differs from these studies in three important ways. First, instead of focusing on the internal spatial organization of a single architectural complex — one that is usually civic, ceremonial, or elite in nature (e.g., Ashmore 1991; Sanchez 1997; Stuardo 2003) — I examine a city's configuration as a whole, taking into account the spatial organization of architecture from all facets of society, including civic-ceremonial buildings, royal compounds, and elite and commoner residences as well as roads and reservoirs. I also incorporate natural features such as rivers, *quebradas* (stream cuts), hills, and mountains. Second, I introduce an innovative methodology that uses GIS to integrate the natural and built environments in the form of a raster dataset called the Urban Digital Elevation Model (DEM) (Ratti 2005; Richards-Rissetto 2007). This Urban DEM serves as the base dataset from which to create least cost paths, thereby allowing archaeologists to quantify accessibility for entire landscapes rather than simply within individual buildings or architectural complexes. Third, my research is multiscalar, studying access and visibility at four scales, from Copán's subcommunities to its physiographic zones to its urban core and hinterlands to the city as a whole.

7.1. Access among the Ancient Maya

Archaeological evidence suggests that accessibility and visibility served as mechanisms of social integration and/or social segregation in ancient Maya society (e.g., Hammond and Tourtellot 1999; Houston et al. 2006; Stuardo 2003). The Maya intentionally constructed their built environment to control access, manipulate the flow of movement, and send visual messages (Hammond and Tourtellot 1999; Keller 2001; Tourtellot et al. 2003; Tourtellot et al. 1999; Stuardo 2003). David Webster (1998:40) writes that Maya builders obviously intended to "to channel movement and create visual impressions of sanctity and power" through the organization of architecture. For example, at Copán the east and west *sacbeob* channeled people into the large, open Great Plaza, presumably for ritual events that brought together people from all walks of life (Baudez 1994; Sanchez 1997). It is likely that the accessibility of these plazas sent a message of unity — "we are one" — and created a sense of community and shared identity that helped to maintain social cohesion between commoners and elite.

In contrast, the highly restricted spaces of the East and West Courts of the Acropolis most likely sent different messages to different people (Figure 7.1). At most Maya sites, intimate access to the royal court was "restricted to the nobility and invited guests, spatial control being an integral part of the orchestration and wielding of regal power" (Reents-Budet 2001:225). On the one hand, it forged social bonds between the royal elite and other elite. On the other hand, it segregated the elite from the commoners by not permitting commoners access to certain spaces. This segregation helped to establish and maintain social inequalities. By making these royal spaces more inaccessible and separating the elite from the commoners, the ancient Maya were effectively replicating the order of the cosmos, in which supernatural beings and lords were separated from lesser or lower beings (Houston et al. 2006). Archaeologists have talked about the accessibility or inaccessibility of spaces within courtyard groups, but no one has empirically evaluated whether this same phenomenon is replicated for cities as a whole.

7.2. Configurational Analysis

Configurational analysis states that a city's configuration, or its morphological form, is a cultural product, and the way in which it is laid out influences how cultural information is transmitted (e.g., Hillier 1999; Hillier and Hanson 1984; Hillier et al. 1993; Marcus 1983; Preziosi 1979a, 1979b). Through mechanisms of accessibility

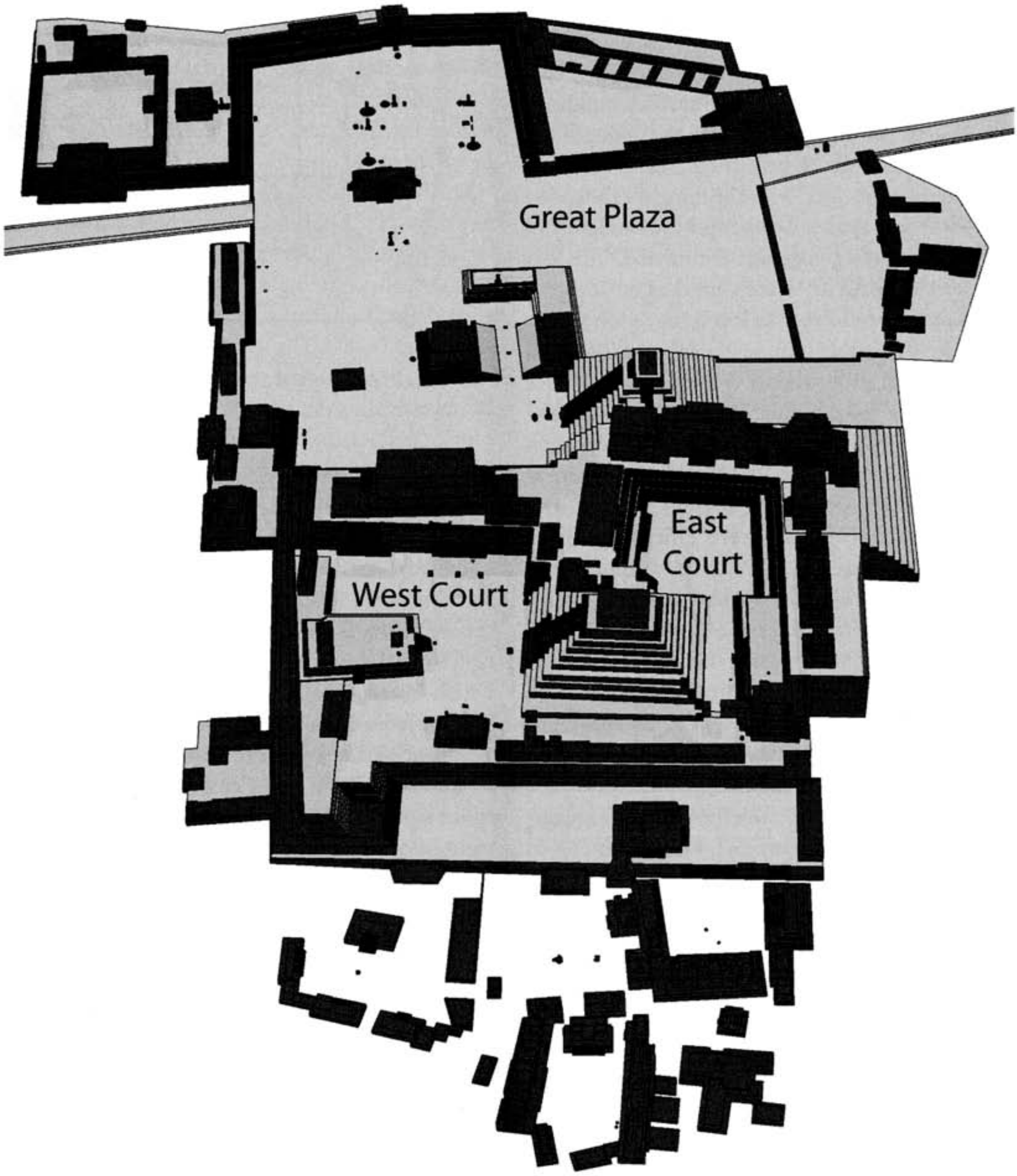

FIGURE 7.1. GIS-based Google SketchUp reconstruction of Copán's Principal Group.

and visibility, people send messages that help integrate some people while segregating others. Access structures social interaction by influencing pedestrian movement *to* and *through* space, and visibility does so by visually connecting certain groups to one another and not to others (e.g., Bustard 1996; Ferguson 1996; Hillier et al. 1993; Hillier and Hanson 1984; Ratti 2004, 2005; Shapiro 2005).

Most archaeological studies of accessibility use a form of configurational analysis called space syntax, which analyzes the structure of space to predict pedestrian movement (e.g., Bustard 1996; Ferguson 1996; Hillier and Hanson 1984; Hillier et al. 1993; Ratti 2005; Shapiro 2005; Stuardo 2003; see Hudson this volume for an alternative approach to space syntax). This work is based on studies indicating that spatial configurations are the primary generators of patterns of movement (Hillier et al. 1993). In other words, people are more likely to walk to or through certain spaces than others because of the way in which buildings and spaces are laid out. Spaces that people are more likely to walk to or through are considered to be more connected with the system as a whole, whereas those spaces that people are less likely to walk to or through are less connected. This degree of connectivity is measured as an integration value. Locations with low integration values are more accessible (connected) than those with higher integration values (Hillier 1999; Hillier and Hanson 1984; Hillier et al. 1993). These degrees of accessibility are related to variables such as political control and ritual exclusion (Ferguson 1996; Hillier and Hanson 1984; Smith 2007).

Many archaeologists have employed space syntax to study social interaction in ancient societies from across the world, including Medieval Europe, North America, Mesopotamia, and Mesoamerica (Dawson 2002; Craane 2009; During 2001; Stuardo 2003). In the U.S. Southwest, archaeologists used space syntax to study social interaction at several ancestral pueblos, including Arroyo Hondo, Pueblo Bonito at Chaco Canyon, and Zuni Pueblo (Bustard 1996; Shapiro 2005; Ferguson 1996). T. J. Ferguson's (1996) work at Zuni Pueblo, New Mexico, illustrated how changes through time in architectural configurations reflected wider sociopolitical changes. The space syntax results indicated that from AD 1400 to 1800 Zuni's inhabitants built structures that served to increasingly restrict accessibility to particular spaces within the community. These changes corresponded to ongoing threats of Apache and Navajo raids at the pueblo, suggesting that these relatively inaccessible areas may have been used to shelter women and children during raids.

In regard to Maya studies, space syntax has been applied to examine differences and similarities in access patterns within royal compounds across the Maya region. An example of such work is Rodrigo Liendo Stuardo's (2003) comparisons of access between Classic (AD 250–950) royal architecture at the sites of Palenque, Tikal, and Uaxactún in the southern lowlands and Early Postclassic (AD 950–1250) royal architecture at Uxmal, Labna, Kabah, and Sayil in the northern Yucatan. His work demonstrates that simple access patterns existed in the elite architectural complexes of the northern Yucatan, while more complex patterns existed in southern lowland palaces. These differences suggest changes in political organization from the Classic to Early Postclassic periods, which Stuardo believes reflect a Postclassic departure from Classic forms of rulership to a more decentralized system of rulership under a council of nobles (Schele and Friedel 1990). Although space syntax has proven useful for providing insight into ancient social interaction within architectural compounds (e.g., Bustard 1996; Ferguson 1996; Shapiro 2005; Stuardo 2003), I believe that because of the way in which it measures integration, its utility for studying access in large Maya centers is limited (Cutting 2003).

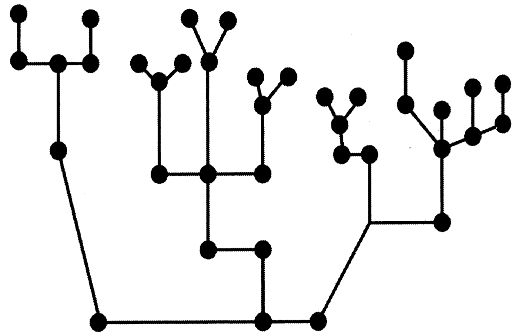

FIGURE 7.2. Hypothetical axial map of architectural complex.

7.3. Limitations of Space Syntax Methods

I contend that the limitations of space syntax are predominantly due to the traditional methodology of measuring integration with axial maps, which rely on simple longest-line-of-sight mapping derived from planimetric representations (Figure 7.2). Axial maps are problematic because measurements are two-dimensional rather than three-dimensional (Batty 2004; Hudson this volume; Ratti 2004, 2005). Such maps may be sufficient for measuring the accessibility of interior spaces for buildings or even architectural compounds; however, they cannot accurately measure accessibility across large Maya cities. This is because they do not take into account distance, topography, or the effects of barriers and facilitators on the *cost* of movement in the landscape.

Taking these factors into account is important because Maya communities comprise both the built environment and the natural landscape (Plate 6). Among contemporary Maya the term for large community is *kahkab*. *Kah* means "populated place," and *kab* means "land" or "earth"; in joining these words, the Maya essentially combine the built and natural environments (Marcus 2000:236). In other words, unlike the Western concept of city as human-made, the Maya view their communities as a construct of both the natural and built worlds. The ancient Maya seem to have had similar ideas. Along the Usumacinta River in Guatemala, they constructed temples atop caves that during the wet season were filled with fast-flowing water that sent a roaring sound up through these temples (Brady and Ashmore 1999). By fusing their built and natural surroundings, they were able to create an impressive auditory effect that produced a ritually charged atmosphere at specific times of the year. At the site of Copán in Honduras, the ancient Maya used the natural backdrop of the hillsides to heighten certain ceremonial and/or elite structures, making them appear larger than they truly were (Leventhal 1979, 1983).

These examples show that the ancient Maya integrated their built and natural surroundings in order to express ideas and structure events, and thus it follows that they would have also taken into consideration both built and natural features as they configured their surroundings to influence social connectivity within their cities. Given that spatial layout is a primary factor in facilitating and impeding movement and that pedestrian movement to or through particular spaces affects a location's degree of social connectivity, archaeologists must consider the *cost* of movement in configurational analyses. Unfortunately, axial maps are two-dimensional datasets and consequently cannot be used to measure the cost of movement, which is better approximated using three-dimensional data; however, by making use of the capabilities of GIS and least cost analysis (LCA), we can surmount such problems and measure the cost of movement, and ultimately social connectivity, across the Maya *kahkab*.

7.4. An Alternative Approach to Measuring Integration

Zipf's Principle of Least Effort states that interactions between places are inversely proportional to the cost of travel between them (Surface-Evans and White this volume; Zipf 1949). This means that people are more likely to travel to places that they can more easily reach or to which they will expend less energy traveling. Therefore, it follows that people are more likely to interact with people living at locations that are more easily reached than those living at hard-to-reach places. This often translates into greater interaction with one's neighbors, that is, those individuals who live close by rather than those who live far away. However, proximity, or distance, is only one variable affecting travel cost. Topography, hydrology, cultural features, and other factors also affect travel cost or the likelihood for interaction to occur (e.g., Kantner 2004; Llobera 2000; Miller 2006).

A GIS can simultaneously evaluate the effect these many variables have on the cost of pedestrian movement; thus, it is ideal for developing an alternative to axial graphs for measuring integration at ancient Maya sites. In GIS terms, axial graphs make measurements using a vector map; however, a much more powerful data type is available: the raster map. In a recent issue of *Environment and Planning B: Planning and Design* (2005), Carlo Ratti explores how the Urban Digital Elevation Model)—a raster map that stores elevations and building heights—can serve as a better alternative to the axial maps typically used in space syntax. Ratti suggests measuring the integration, or connectivity, of particular locations by using a cost-of-passage function, friction or impedance, to model travel costs across ancient landscapes. In the GIS, this translates to using the Urban DEM and employing algorithmic functions to merge several raster datasets into a single friction surface embedded with data on facilitators such as *sacbeob* (roads) and barriers such as structures, rivers, and *quebradas* to create least cost paths (Figure 7.3).

The friction surface for this study was created (1) using the union function to combine several shapefiles (representative of different archaeological features) into a single shapefile, (2) converting

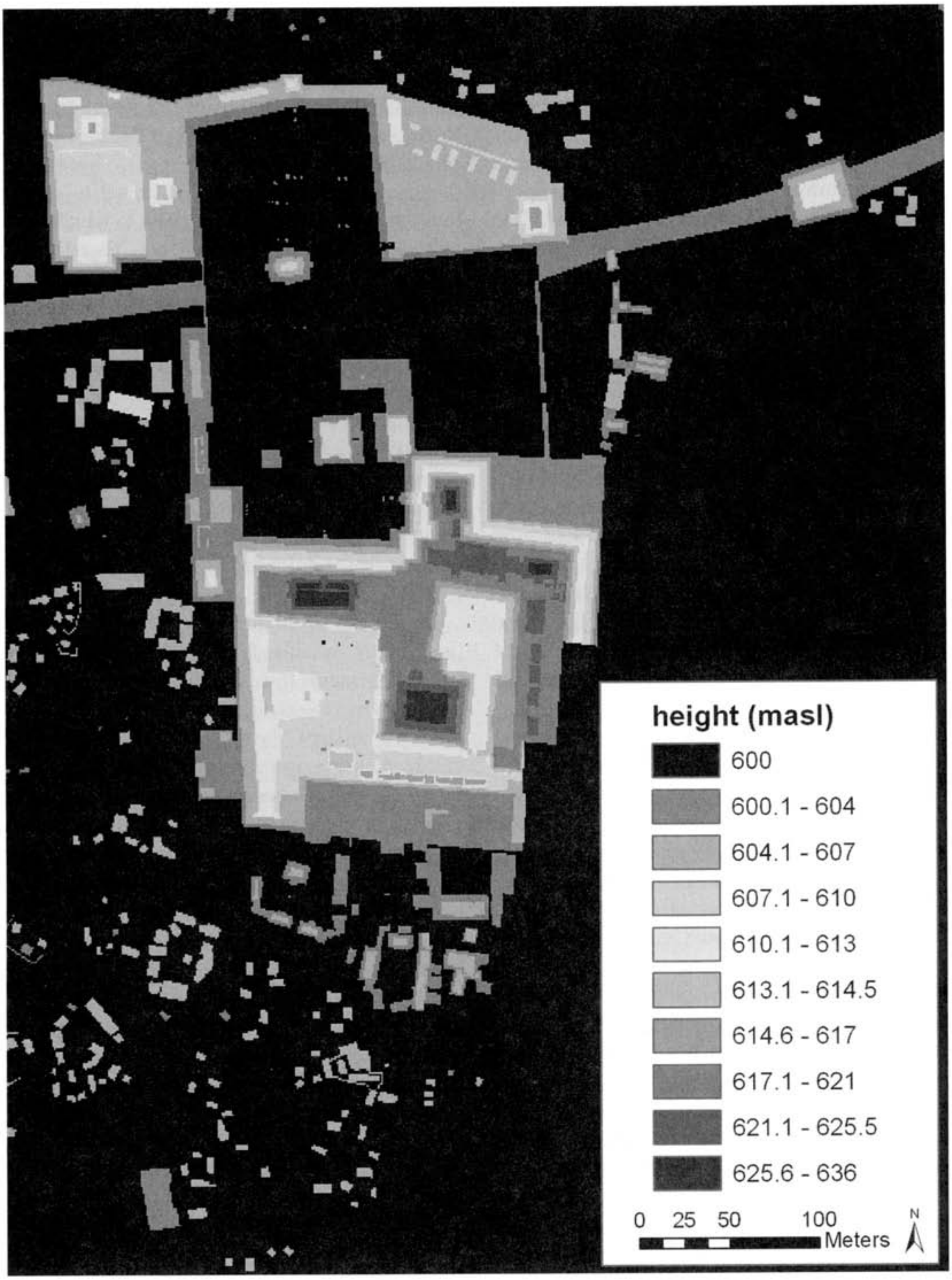

FIGURE 7.3. Urban DEM of Copán's Principal Group showing building heights in a raster (pixel-based) format that allows for LCA in a GIS.

this shapefile into a raster dataset, and (3) reclassifying the *sacbeob*, structures, and hydrology features into three classes: facilitators, barriers, and no change. The *sacbeob* were classified as facilitators and assigned a value = 0.9 because they attract and facilitate pedestrian movement. The Río Copán and *quebradas* were classified as barriers, or features that would increase the cost of movement, and were assigned a value of 3. The reservoirs and the structures were also classified as barriers and were assigned a value of 999 — a high enough value to ensure that they would not be crossed. Spaces without archaeological features or hydrological features were classified as areas of no change and were assigned a value of 1. Ultimately, the reclassified dataset was integrated with the Urban DEM to take into account impedance (cost of movement) and generate least cost paths.

Least cost paths are not necessarily the shortest or quickest routes, but routes that involve the lowest travel costs (based on input criteria). In a GIS, a cost-of-passage function is employed to calculate the accumulated cost of moving from a source or set of sources to a destination or set of destinations. The path with the lowest value, or cost, is highlighted as the least cost travel route. The *average* values of these least cost paths indicate the likelihood that movement will occur to or through a particular space, that is, the likelihood that an individual will pass through that particular space. For example, people are more likely to walk to or through those sites with lower path costs than those with higher path costs (Hillier 1999; Hillier and Hanson 1984; Hillier et al. 1993). Significantly, this provides a method to quantify the degree of connectivity between spaces, which serves as a proxy for determining how integrated or segregated different groups of people (based on site type and site location) were in ancient landscapes. The ability to quantify connections using cost-based measures was lacking in previous space syntax studies.

Using the Urban DEM and friction surface, we can determine the average cost of travel using least cost paths from a certain point to all other relevant points. In this way, differences in cost to travel from one type of household to other types of households or to other points of interest such as stelae or monumental architecture can be measured. These measures are referred to as integration values (as in space syntax) and are used to provide information on interaction patterns between different social groups and different parts of cities, allowing archaeologists to tackle the question whether social integration and social segregation in prehistoric cities can be *quantitatively* addressed. The *average* value of the least cost paths from a source site to a subset of sites provides the integration values that indicate the degree of connectivity between people of different social groups or people living in different parts of Copán. The maps in Figures 7.4 and 7.5 compare least cost travel paths from Group 11L-13 in Copán's El Bosque suburb to two different site types (type 1 and type 2). The integration value for travel to type 2 sites from Group 11L-13 is 4068.67 (Figure 7.4). The integration value for travel to type 1 sites from Group 11L-13 is 5681.47 (Figure 7.5). The lower integration value (or lower cost of travel) for travel to type 2 sites indicates that people living in El Bosque were more socially connected with people living at type 2 sites than with people living at type 1 sites. These integration values allow archaeologists to assess the potential for interaction between different groups by quantifying the degree of connectivity between them.

Several steps were involved in the design and development of the GIS data that were used to create these least cost path maps and generate integration values:

1. Scan maps and architectural plans and drawings
2. Georeference scanned images
3. Digitize archaeological and natural features from these georeferenced images to create shapefiles
4. Attribute shapefiles (e.g., site types, group ID, structure ID, elevation)
5. Convert polylines shapefiles to polygon shapefiles
6. Convert shapefiles to raster files
7. Create digital terrain model (DTM)
8. Create Urban DEM from DTM and raster files
9. Create friction surface
10. Generate slope from the Urban DEM
11. Integrate slope and friction surface to derive cost-distance and cost-direction surfaces

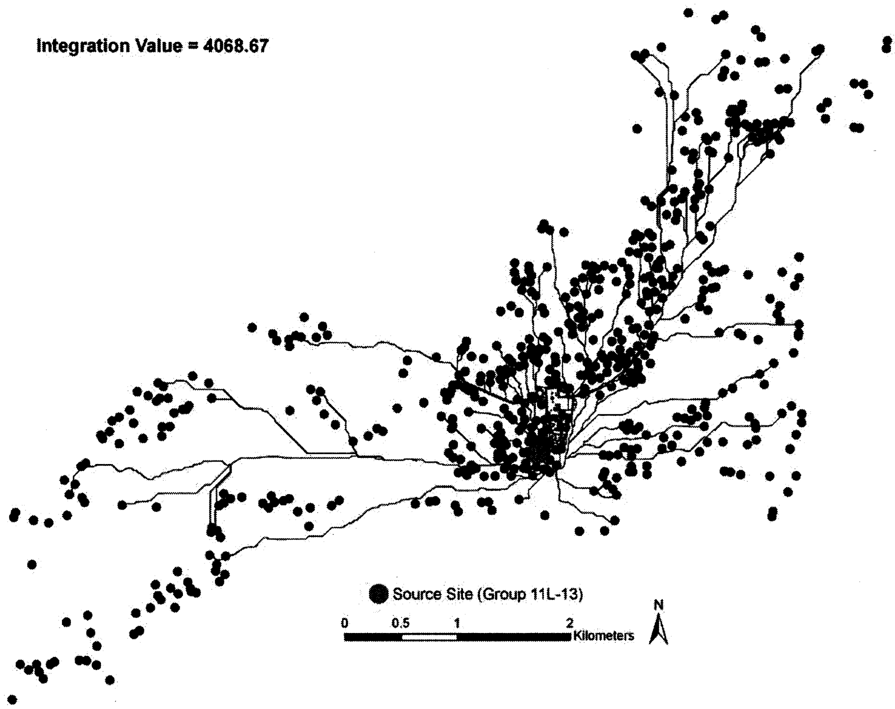

FIGURE 7.4. LCP map for travel to type 2 sites from Group 11L-13 in the suburb of El Bosque at Copán, Honduras.

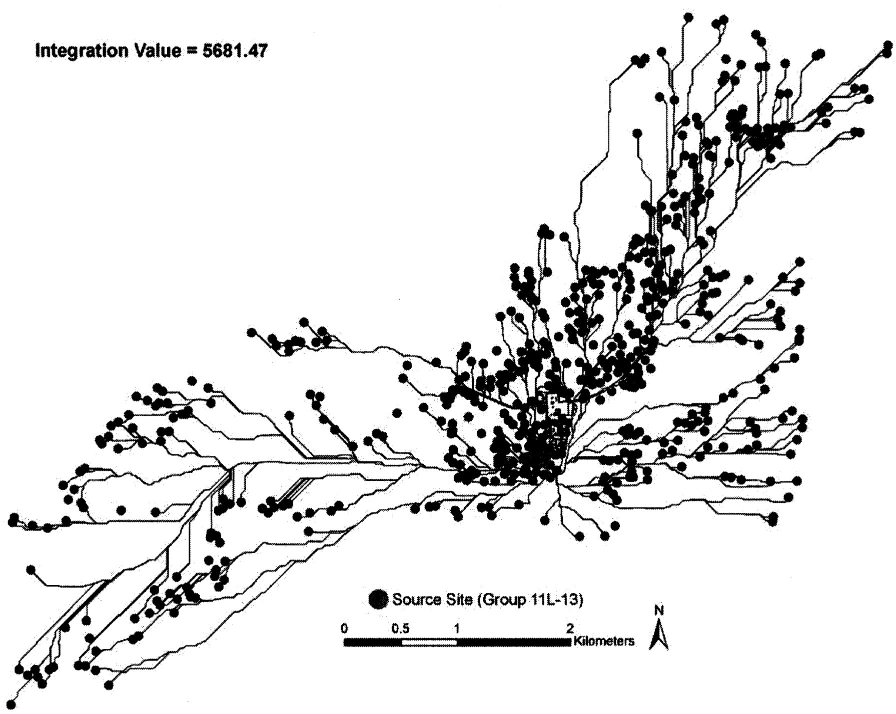

FIGURE 7.5. LCP map for travel to type 1 sites from Group 11L-13 in the suburb of El Bosque at Copán, Honduras.

FIGURE 7.6. Three-dimensional reconstruction of the Copán Valley in the late eighth and early ninth centuries (ad 763–820) showing settlement pattern in relation to natural topography and hydrology.

12. Generate least cost paths from 74 sample sites to all (594) sites at Copán
13. Classify least cost paths based on site types 1–5
14. Export classified path costs (integration values) to Excel
15. Import path costs (integration values) to Minitab 15 for statistical tests

The data were created using the Environmental Science Research Institute's (ESRI) ArcGIS 9.1, a GIS software package, and analyzed using ArcGIS 9.2. Minitab 15, a statistical software package, was used to evaluate the statistical significance of the integration and visibility analyses.

7.5. Case Study: Copán, Honduras

This research focuses on site organization in the late eighth and early ninth centuries (AD 763–820) at the ancient Maya site of Copán, Honduras (Figure 7.6). This site serves as an ideal case study, for two reasons. First, for practical reasons, its long history of research provides voluminous survey and excavation data. Archaeologists have carried out a full-coverage survey (100 percent) and instrument-mapped all visible archaeological features in the Copán Valley (27 km^2) at a scale of 1:2000 (Baudez 1983; Fash and Long 1983; Leventhal 1979; Willey et al. 1978), and architects have used photogrammetric studies to map Copán's Principal Group and several elite complexes at a scale of 1:200 (Hohmann 1995; Hohmann and Vogrin 1982). These analog data were scanned, georeferenced, and digitized to create the GIS data used in this research.

Second, the Harvard Site Typology—a five-part classification scheme at Copán—provides a means to analyze how people living at different site types organized themselves within the city because it correlates site types to socioeconomic status (Willey et al. 1978; Willey and Leventhal 1979). The typology comprises five site types (1–5); it is assumed that commoners lived at site types 1 and 2, and the elite occupied site types 3 and 4 (Plate 7). There is only one type 5 site at Copán—the city's major civic-ceremonial complex, the Principal Group (see Figure 7.1).

When speaking of restricted access at ancient Maya sites, scholars typically refer to access to the interior spaces of elite residences and civic-ceremonial complexes. They assume that access is limited to other elites (unless the person is a member of the household or serves as some sort of laborer); this is most likely a valid assumption, but it does not address how integrated the elite living at a specific compound may be with respect to society as a whole and to people from different social groups. My research differs from other accessibility studies because it explicitly measures social connectivity across the city as a whole and addresses such questions as, Were elites living at type 4 sites more or less integrated with society as a whole, with people living at specific site types (1–4), with the ruler, or with the site's civic-ceremonial center? I asked the same questions of elites and commoners living at site types 1–3 at Copán.

7.6. Results

The way ancient people constructed and organized their physical surroundings and spaces provides information about their past lives; physical configurations are created that both mirror and shape social interaction among different social groups (Cutting 2003; Moore 2003, 2005). These configurations occur on many scales, from single households to multifamily architectural complexes to neighborhoods to cities. A benefit of multiscalar studies is that they bridge household studies and settlement pattern studies, often focused on commoners and everyday life, with those oriented toward the elite (Marcus 2000; Yaegar and Canuto 2000).

Given that the goal of my research is to investigate social connectivity across social groups, I employed a multiscalar analysis to examine accessibility at four different scales in the Copán Valley: (1) valley-wide, (2) physiographic zone, (3) urban core–hinterland, and (4) subcommunity. The objectives were to study social connectivity:

1. between (rather than within) Copán's twenty-one subcommunities to study differences and similarities across subcommunities
2. between the urban core and its hinterland to study core-periphery relationships
3. between the valley's five physiographic zones to understand the potential influence of ecological variables on structuring pedestrian movement
4. for the city as a whole to understand how Copán's different social groups may have interacted across the valley.

A nonparametric statistical test, the Kruskal-Wallis test, was used to evaluate whether the differences in integration values between site types were statistically significant. (This statistical test offers an alternative to the ANOVA—one-way analysis of variance—for nonparametric data.) Summary tables and results for each analytical scale are presented below.

7.6.1. Valley-Wide

The valley-wide accessibility results identify a pattern that supports the assumption that the ancient Maya of Copán used accessibility to differentially channel pedestrians throughout the valley. The city's layout seems to have served as a guide to daily interactions, facilitating pedestrian movement from across the valley toward the highly accessible main civic-ceremonial complex, the Principal Group. The integration values presented in Table 7.1 indicate that people were channeled toward elite sites, suggesting that the elite were more socially connected to society as a whole than were commoners. The data show that the cost for people living at any site type to travel to the large, open Great Plaza is lower than the cost to travel to any other site type in the valley. Elites living at type 4 sites were situated at strategic locations, affording them the greatest access, excepting the king, to all the city's residents.

The data also indicate that people living at type 3 sites were more integrated with society as a whole than people living at type 1 and type 2 sites. (Interestingly, however, the values for type 2 [commoner households] and type 3 sites are more similar than the values for type 3 and type 4 sites, presumably both elite complexes—an important point that I revisit below.) The valley-wide access pattern indicates that as social status increased, accessibility increased. Previous studies show that people living at highly integrated locations can more easily exercise their authority as a result of their greater accessibility to both people and resources (Hillier 1999; Hillier and Hanson 1984), and thus the results suggest that the elites living at type 3 and type 4 sites positioned themselves at locations on the landscape that would help centralize their power.

TABLE 7.1. Valley-Wide Integration Values, Copán.

Site Type	*N* (paths)	Integration Value
1	25890	7246
2	3465	6297
3	1469	5842
4	925	5136
Great Plaza	586	3412
Acropolis	587	4130
Royal Courtyard	583	4061

p-value = <0.0001

Residents of type 1 sites were the least integrated, which suggests that the roles they played in society did not necessitate a high degree of connectivity with people across the valley. Residents of type 1 sites were less likely to interact with Copanecos of any social status, and thus they are considered more socially isolated. Perhaps the roles they played in society did not require routine communication with occupants living in many other parts of the valley. Their relative social isolation may have meant that they were a lesser target of social control, and their lower status may have provided them with more autonomy than other social groups at Copán.

Tables 7.2–7.4 illustrate the degrees of integration (connectivity) between Copán's Principal Group areas and the city's residential site types. They show that the city's configuration facilitated interaction between the type 4 occupants and the city's major civic-ceremonial complex, providing them with the greatest access to the ruler, other members of the royal court, and the ritual ceremonies performed in the city center (Inomata and Houston 2001). These tables also illustrate another interesting observation. According to the Harvard Site Typology, elites lived at type 3 and 4 sites and commoners lived at type 2 sites; therefore, I expected that the integration values for type 3 and 4 sites would be more similar than the integration values for type 2 and 3 sites. However, as the tables show, this is not the case: the integration values for type 2 and 3 sites are more similar. These results may indicate that the occupants of type 2 and type 3 sites played similar economic, social, and/or political roles at Copán, suggesting that the Harvard Typology requires some refinement.

TABLE 7.2. Integration Values for the Great Plaza.

Site Type	*N* (paths)	Integration Value
1	434	3987
2	107	2366
3	25	2080
4	16	1569

p-value = <0.0001

TABLE 7.3. Integration Values for the Acropolis.

Site Type	*N* (paths)	Integration Value
1	434	4853
2	107	3003
3	25	2970
4	16	2553

p-value = <0.0001

TABLE 7.4. Integration Values for the Royal Courtyard.

Site Type	*N* (paths)	Integration Value
1	433	4599
2	107	2917
3	25	2672
4	16	2128

p-value = <0.0001

In sum, the valley-wide results indicate that as accessibility increased, social status increased, and therefore the findings support the assumption that accessibility served as a mechanism to help create and maintain distinct social categories and ostensibly reinforce the cosmic order at Copán.

7.6.2. Physiographic Zones

The results of the physiographic zone portion of this study indicate that ecological variables alone are not responsible for differences in social connectivity across the valley (Table 7.5). In some cases, zones with very different landforms and topography have similar integration values, while zones with similar landforms and topography often have very different integration values. An interesting observation is that zone 5, which has the shortest occupation history (archaeological remains date only to the Middle Preclassic and

TABLE 7.5. Integration Values for the Physiographic Zones.

Zone	*N*	Integration Value
2	5136	4425
3	14759	5951
4	6817	5535
5	9781	11126

p-value = <0.0001

TABLE 7.6. Integration Values for Site Types by Physiographic Zone.

Site Type	Zone 2	Zone 3	Zone 4	Zone 5
Type 1	5746	6389	6049	11346
Type 2	3771	5245	5146	11224
Type 3	3541	5312	4838	10361
Type 4	2675	4464	4435	9344
Great Plaza	1783	3372	3723	9886
Acropolis	2515	4308	4509	10916
Royal Courtyard	2083	4469	3757	10839

p-value = <0.0001

TABLE 7.7. Integration Values for the Urban Core vs.the Hinterlands.

Area	*N* (paths)	Integration Value
Urban Core	11294	4387
Hinterland	25199	7970

p-value = <0.0001

Late Classic periods with no intermittent occupation), was the least integrated area of the site. The cost to travel from sites in zone 5 to other parts of the valley was two to three times more than it was for any other physiographic zone.

One explanation is that zone 5's high integration values may reflect less sociopolitical control on the part of Copán's ruling class. As Copán's ruler and elite experienced more difficulties in the later years of the Late Classic, they may have had less control over where people lived. Instead of being restricted to living in more highly centralized areas of the city, people may have enjoyed a new freedom to build in more distant locations. These decentralizing tendencies may reflect a loss of power for Copán's ruling authority (Fash 2001). An alternate explanation is that these low values may simply be due to rapid Late Classic population growth that would have required the occupation of new and more distant lands, presumably in great part for agricultural purposes. Regardless of the causes, these high integration values indicate that people living in zone 5 were more socially isolated from society as a whole than were people living in other zones.

Like the valley-wide results, the data indicate that a marked difference exists in the integration values of type 3 and 4 sites (Table 7.6). In all zones (except zone 5), the integration values of site types 2 and 3 are closer than the integration values of site types 3 and 4. These results provide another line of evidence suggesting that the Harvard Typology may need to be refined.

7.6.3. Urban Core–Hinterlands

The integration values in Table 7.7 show that people living in the urban core exhibited a higher degree of social connectivity than did people living in the hinterlands. These differences are most likely due in part to variability in settlement density and site type distribution between the urban core and the hinterlands. However, they may also arise from temporal variation. Archaeological excavation and test units indicate that the urban core is the oldest and most continuously occupied part of the valley (Fash 1983; Hall and Viel 2004; Sanders 1986). The accessibility patterns indicate greater social control within the urban core and less social control within newer areas, that is, the hinterlands. These findings may reflect a pattern of growth and development that is difficult to test without more excavation data, although it is still worth noting.

The values in Table 7.8 indicate that pedestrian movement was channeled toward elite compounds (site types 3 and 4) in both the urban core and the hinterlands. By channeling people past their elaborate architecture, the elite were able to remind others of their power and wealth on a daily basis as well as facilitate social interaction between themselves and other members of society. While people were channeled to both urban and hinterland elite sites, the larger differences in the integration values of urban core sites suggest greater social control in this part of the Copán. In contrast, smaller differences in integration values between sites in the hinterlands suggest less sociopolitical control outside the city's center. Before the Late Classic, Copán's different site types may have been more equally dispersed across the landscape. As the years passed, Copán's rulers and other elite appeared to have intentionally aggregated their residences in the urban core, close to one another and to the royal precinct (Fash 2001). This aggregation suggests the development of greater social inequalities between the elite and the commoners, reflected in the older areas of the site but less evident in the younger parts of the valley.

Like the results for the valley-wide and physiographic zones, the differences in integration values for sites in the urban core versus those in the hinterlands point to additional problems with the Harvard Site Typology. For example, although the difference in type 1 and type 2 integration values in the urban core is striking, the difference is much less marked in the hinterlands. The results suggest that people living at type 2 urban sites were relatively integrated with society as a whole, and yet people living at type 1 urban sites were not. In contrast, people living at type 2 sites in the hinterlands (similar to those living at type 1 hinterland sites) were relatively segregated. Such differences suggest that people living at type 1 and type 2 sites in the urban core played distinct and different roles in Copaneco society, while individuals living at the same site types in the hinterlands did not. Consequently, they may point to spatial variation and social distinctions (e.g., farmers vs. servants) that are not accounted for in the Harvard Typology.

7.6.4. Subcommunities

The subcommunity results help to refine the urban core–hinterland results by subdividing the valley into three intermediate-level interaction spheres based on varying degrees of social connectivity. The integration values indicate a high degree of channeling to elite sites in the urban core, a moderate degree of channeling to elite sites in eastern subcommunities, and a low degree of channeling to elite sites in western and far eastern subcommunities. Large differences in integration values reflect high degrees of sociopolitical control and social segregation because they reflect greater control over pedestrian movement, and small differences reflect low degrees of sociopolitical control and social integration

TABLE 7.8. Integration Values for Site Types in the Urban Core vs. the Hinterlands.

Site Type	Urban Core	Hinterlands
Type 1	5293	8212
Type 2	3572	7792
Type 3	3312	7294
Type 4	2623	6967
Great Plaza	1847	5727
Acropolis	2604	6637
Royal Courtyard	2476	6616

p-value = <0.0001

because they reflect less control over pedestrian movement (Ferguson 1996; Hillier 1999; Hiller and Hanson 1984; Hillier et al. 1993). Figure 7.7 illustrates the subcommunity findings, which provide the following information about sociopolitical control and class segregation at Copán.

1. People living in the urban core had the highest degree of social connectivity. However, because urban core residents were highly channeled toward elite sites, they experienced the greatest degree of sociopolitical control and class segregation.
2. People living in eastern subcommunities had a moderate degree of social connectivity and experienced moderate degrees of sociopolitical control and class segregation.
3. People living in western and far eastern subcommunities experienced the highest degree of segregation because the cost to travel to these areas was very high. However, there may have been an advantage to such circumstances — a lesser degree of sociopolitical control and less class segregation.

The subcommunity accessibility results provide additional data that highlight unexpected similarities between type 2 sites and type 3 sites. Like the findings for the other scales of analysis, the integration values for these two site types often lack statistically significant differences, again suggesting that the Harvard Site Typology needs to be reevaluated.

7.7. Reevaluating the Harvard Site Typology

The Harvard Site Typology focuses explicitly on material remains; in contrast, my research on accessibility investigates more subtle nuances that

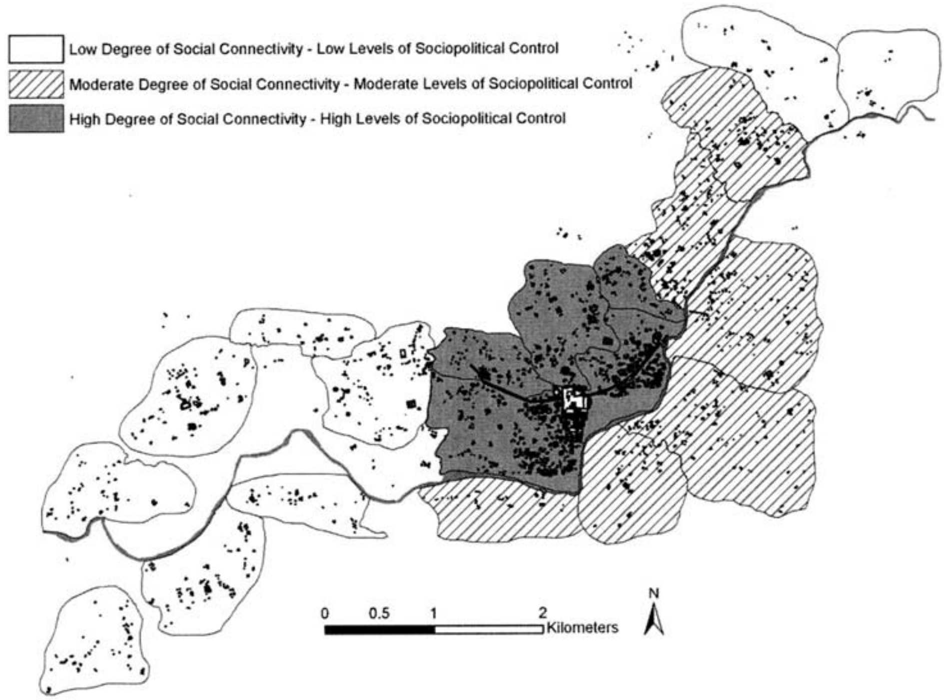

FIGURE 7.7. Three spheres of social connectivity and sociopolitical control, as defined by the LCA, in the late eighth and early ninth centuries at Copán.

reflect and influence sociopolitical organization. The accessibility results highlight similarities between site types 2 and 3 that have not been observed in previous studies, suggesting that perhaps the occupants of site types 2 and 3 played similar economic, social, and/or political roles at Copán or that the Harvard Typology has misclassified some of these sites.

The possible conflation of type 2 and type 3 sites provides evidence supporting the need to more clearly define the differences between site types. Type 2 sites are designated commoner households whereas type 3 sites are designated elite. The expectation is that there would be more similarities between type 1 and 2 sites, both considered commoner, and more similarities between type 3 and 4 sites, both considered elite; however, the access (and visibility) results do not meet this expectation. In many instances, the access (and visibility) values of type 2 and type 3 sites are more similar (see Richards-Rissetto 2010 for visibility analysis). Furthermore, test excavations reveal that some type 2 sites unexpectedly have dressed stone, vaulted roofs, and large numbers of fine wares—traits that are indicative of type 3 sites at Copán (Fash 1983; Webster et al. 2000). These findings lead me to ask, (1) Should some type 2 sites be reclassified as type 3 sites? (2) Should subtypes be created? (3) Is an entirely new classification system needed? and (4) Do we need a typology at all? The answers to these questions require future research.

7.8. Conclusion

Archaeologists traditionally rely on patterns in material culture to understand past societies and their dynamics through time. More recently, archaeologists have focused on the cultural use of space to enrich our understanding of ancient societies (e.g., Hendon 1991; Kent 1984; Lawrence and Low 1990), including investigating the way in which ancient peoples organized themselves in the landscape in order to reconstruct sociopolitical relations. While studies of site organization have been an important part of archaeology for the last half century, it was not until recently that scholars began to regard site layout not simply as a reflection of ancient life but also as a mechanism that shaped it. Seeking to contribute to the growing body of knowledge about the role that site organization played in influencing ancient sociopolitical relations, I developed a least cost approach to investigate the connections between site organization and sociopolitical relations in the late eighth and early ninth centuries at the ancient Maya site of Copán, Honduras.

The results indicate that, in general, Copán's layout replicated and reinforced society's hierarchical class structure—with higher accessibility correlated to higher social status—but that this pattern was not replicated at all societal levels. The access data reveal underlying complexities and sociopolitical relationships that point to the presence of varying degrees of sociopolitical control within the city. Returning to this research's two main questions—(1) Did people of different social classes experience different degrees of social connectivity? and (2) Did people living in different parts of the city experience different degrees of social connectivity?—we see from the study that the answers to these two questions are inextricably linked. People of different social classes experienced different degrees of social connectivity; however, the degree to which specific social groups were either integrated or segregated depended on where they lived. These differences in social connectivity translate into differential degrees of sociopolitical control at Copán. People living in the urban core and eastern subcommunities were channeled toward elite sites and thus experienced greater sociopolitical control than people living in western and far eastern subcommunities, who were not channeled toward elite sites.

In addition to providing information on the relationships among site organization, pedestrian movement, and social structure, the least cost approach to configurational analysis presented in this chapter indicates a need to modify the Harvard Site Typology. The access data suggest that, at least with respect to social connectivity, significant differences did not exist between type 2 and type 3 sites. Given that the Harvard Typology categorizes type 2 sites as commoner households and type 3 sites as elite complexes, these results were unexpected. The implication of the similarities in the integration values of type 2 and type 3 sites is that the typology needs to be refined, most likely in a way that incorporates more social or indigenously derived variables. Such an alteration is important because many interpretations of Copán's sociopolitical organization are heavily influenced by the current site typology.

To conclude, using a modified form of configurational analysis based on least cost paths to measure the relationship between site organization and social connectivity proved fruitful. The LCA identified patterns indicating that Copán's social hierarchy was embedded in the landscape. These patterns, in turn, provided information on how the ancient Maya may have strategically manipulated the landscape to structure social interaction and maintain sociopolitical control.

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